High efficiency defect-based photonic-crystal-tapers designed by a genetic algorithm

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A method based on a genetic algorithm (GA) is used to design the optimum configuration of defects that when put within a photonic crystal (PhC) taper improve the coupling efficiency between dielectric and PhC waveguides [1]. One of the most popular GAs used in combination with multiple scattering theory is considered [2]. This approach optimises the whole configuration of defects simultaneously and, therefore, takes into account the correlation among the defects. Transmission efficiencies up to 94% have been predicted for a 3μm-wide dielectric waveguide into a single-line defect PhC waveguide. This result significantly improves the transmission efficiency of the same PhC taper without defects. On the other hand, the influence of the PhC-taper length on the coupling efficiency has also been analyzed. It is obtained that resonant modes can be excited when the length of the PhC-taper is increased thus degrading the coupling efficiency. However, these resonant modes can be avoided by carefully designing the PhC taper geometry.

[1] P. Sanchis, *et al* "Experimental demonstration of high coupling efficiency between wide ridge waveguides and single-mode photonic crystal waveguides", IEEE Photon. Tech. Lett., vol. 16, pp. 2272-2274, 2004.
[2] A. Håkanson, José Sánchez-Dehesa, and L. Sanchis "Inversed design of photonic crystal devices", to be published IEEE J. Sel. Areas in Commun, 2005.